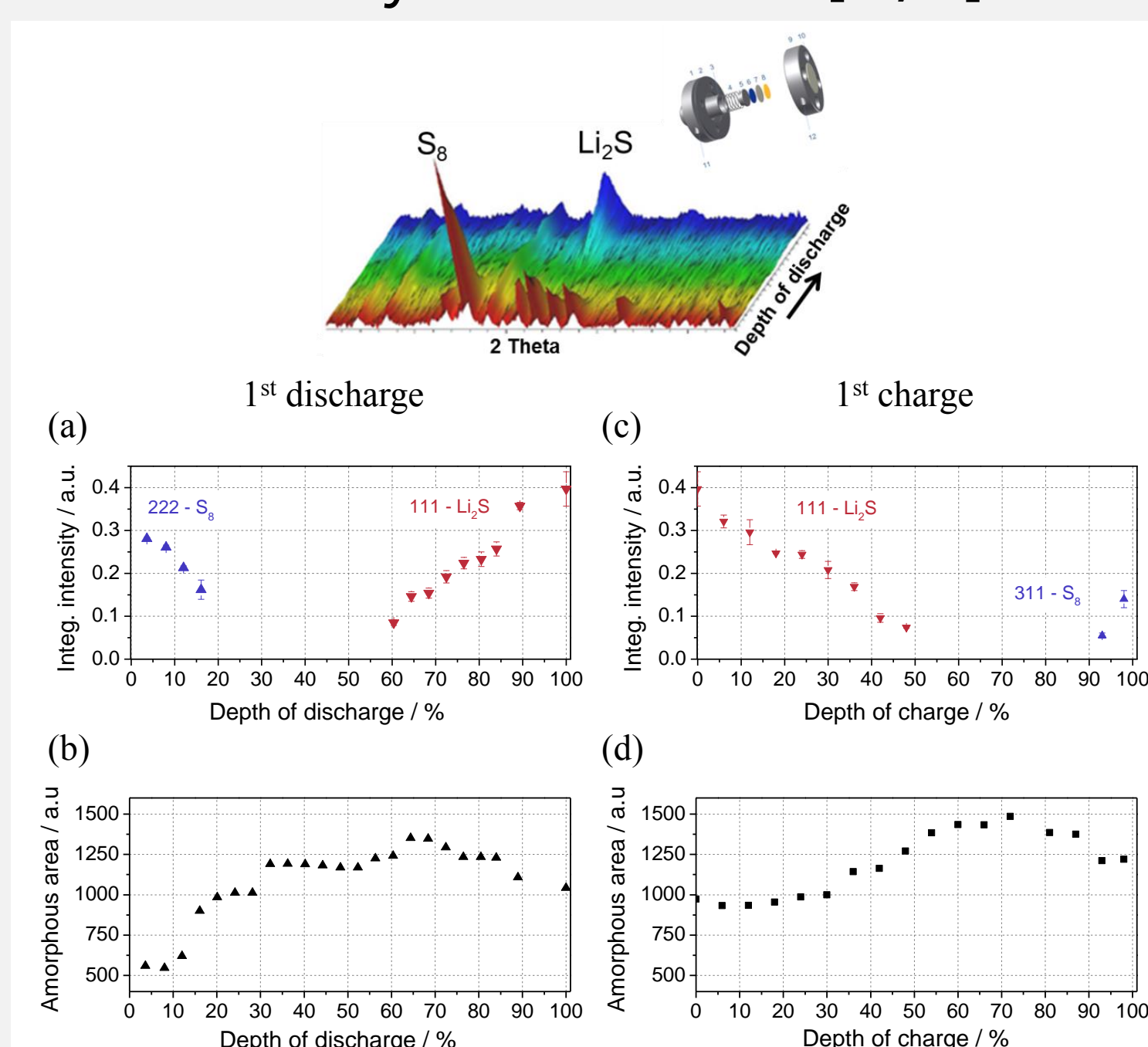


Physical Methods

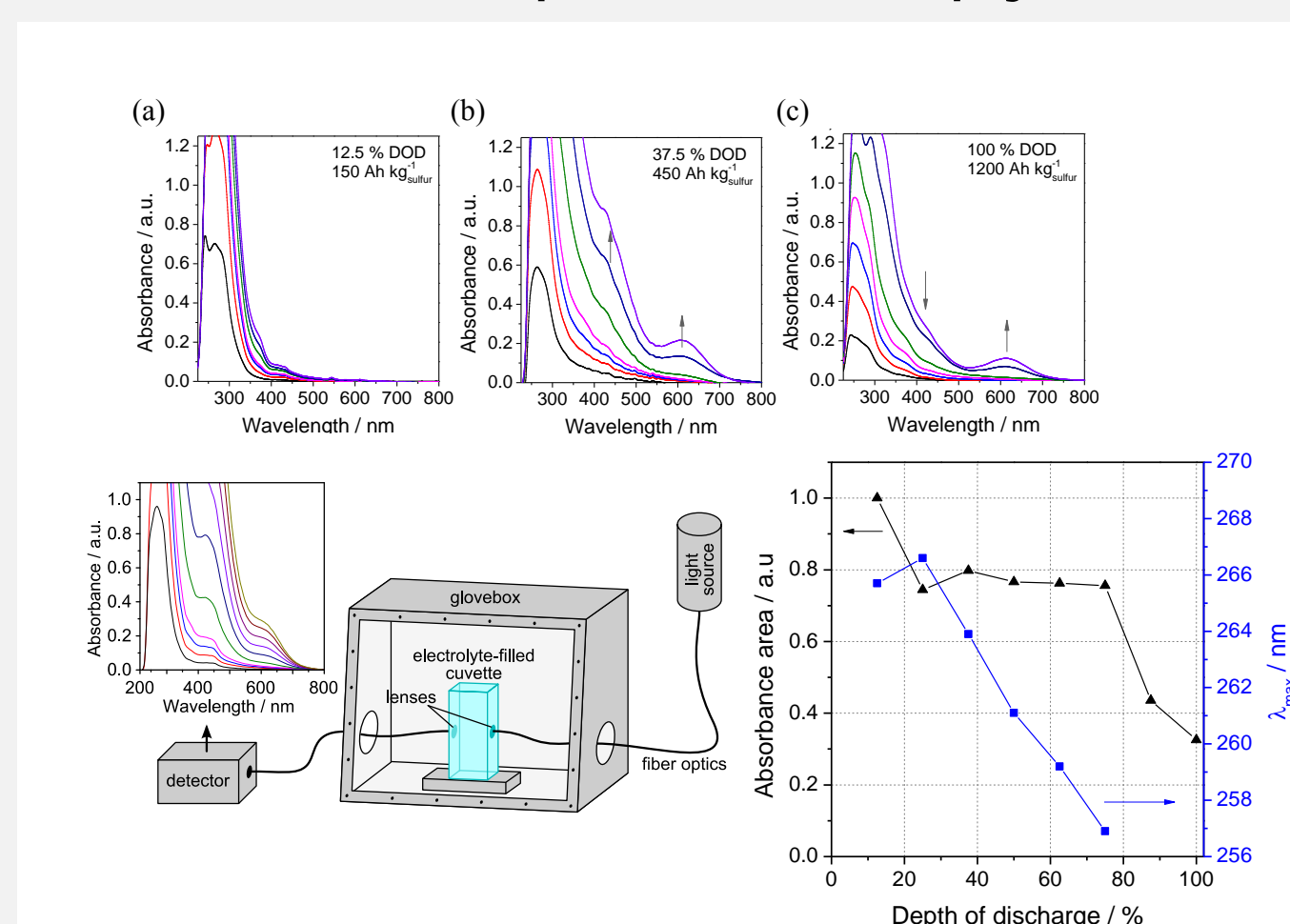
In situ/operando X-ray diffraction [1,4]



For the **first** time:

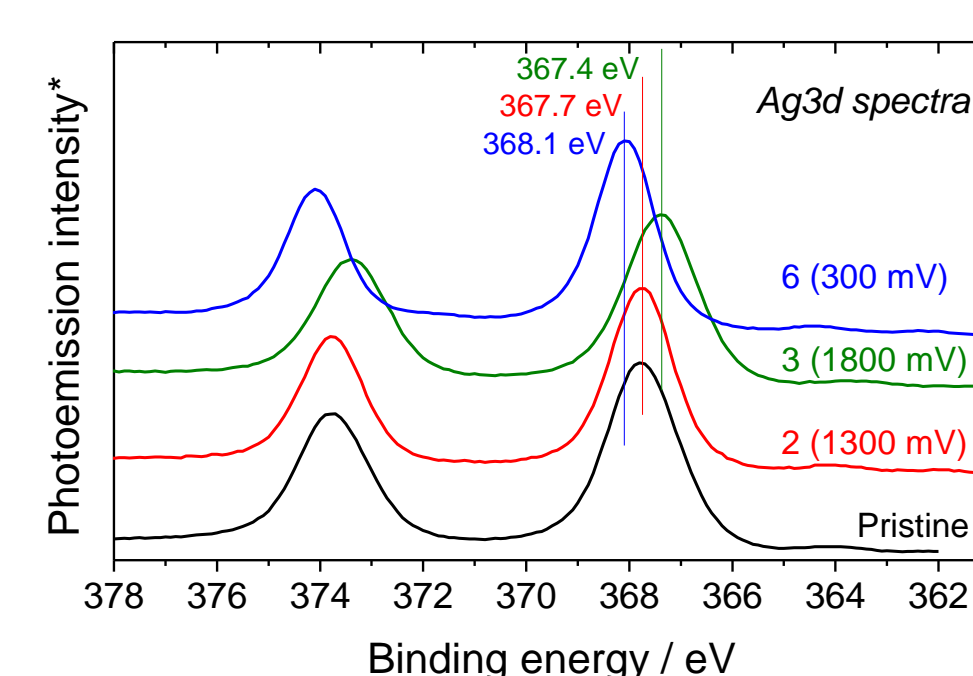
- In situ /operando detection of Li_2S
- Semi-quantification of crystalline products
- Detection of amorphous phase
- Modification for tests at elevated temperatures

UV-Vis spectroscopy [3]



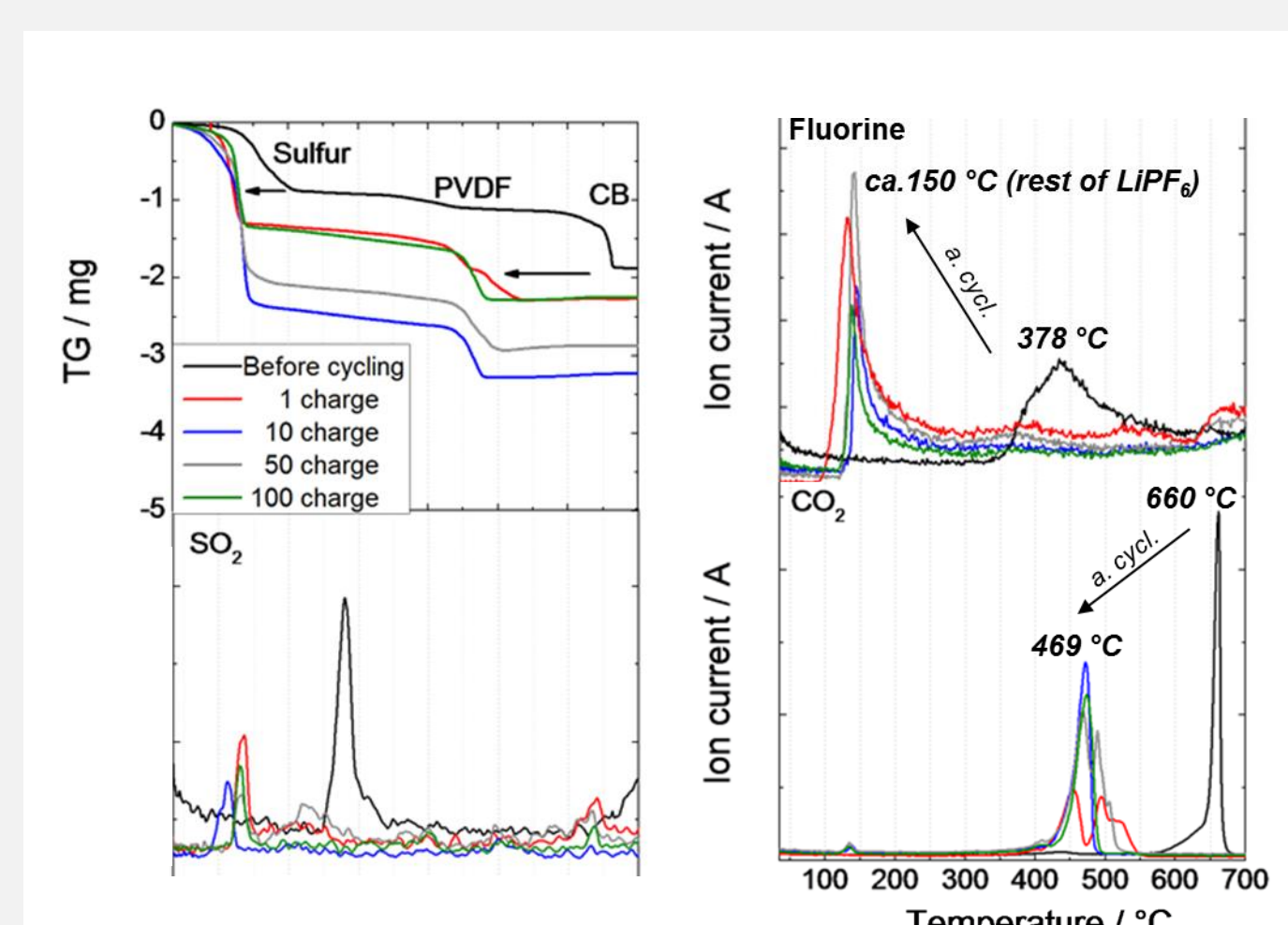
- UV-Vis absorption analysis of sulfur species under argon atmosphere
- Formation and reaction of Li_2S_x : Semi-quantitative analysis

X-ray photoelectron spectroscopy [6]



- Investigation of Ag oxidation states in gas diffusion electrodes for metal air batteries
- High resolution measurements

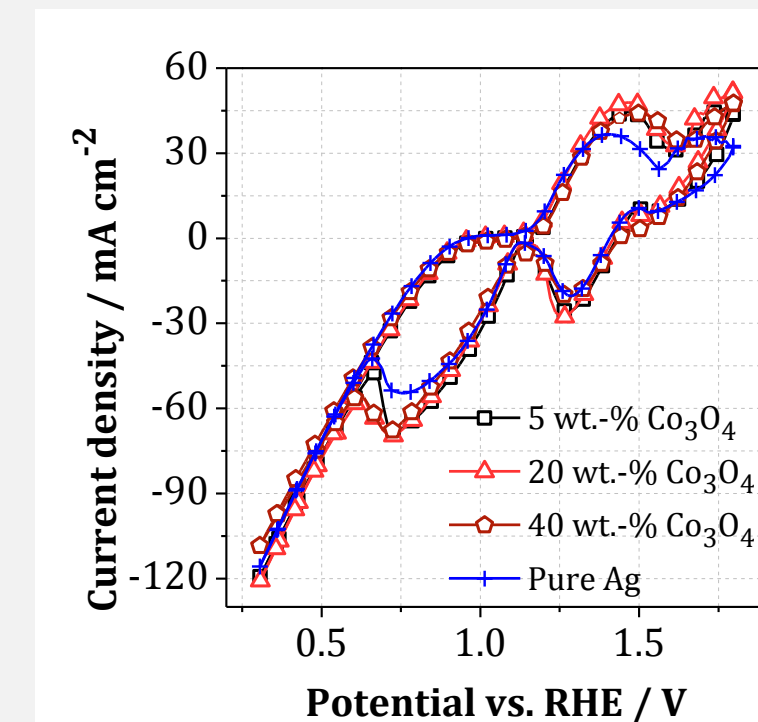
Thermogravimetry coupled with mass spectroscopy [4]



- Reduction of sulfur content on bulk of cathode
- Degradation of PVDF and structure changes of CB

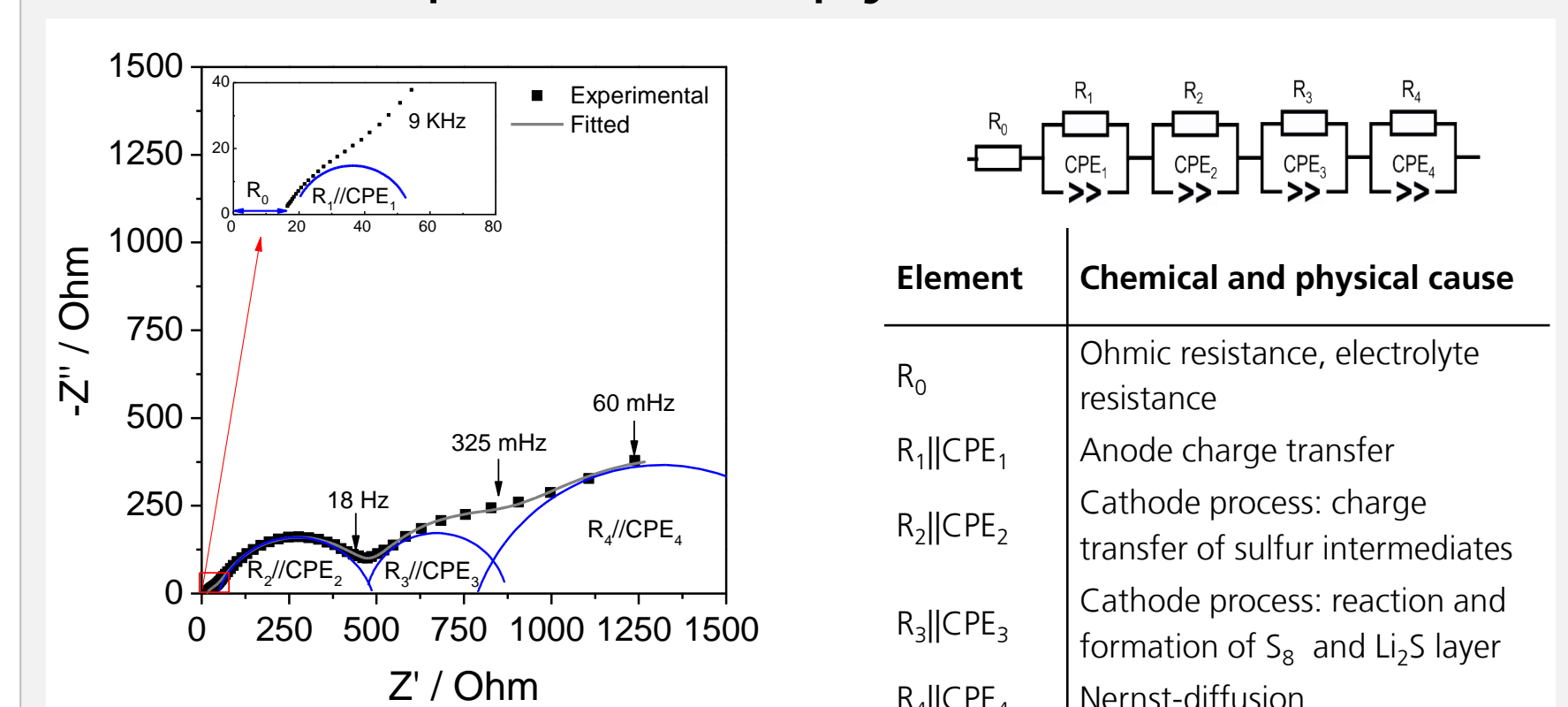
Electrochemical Methods

Cyclic voltammetry [5]



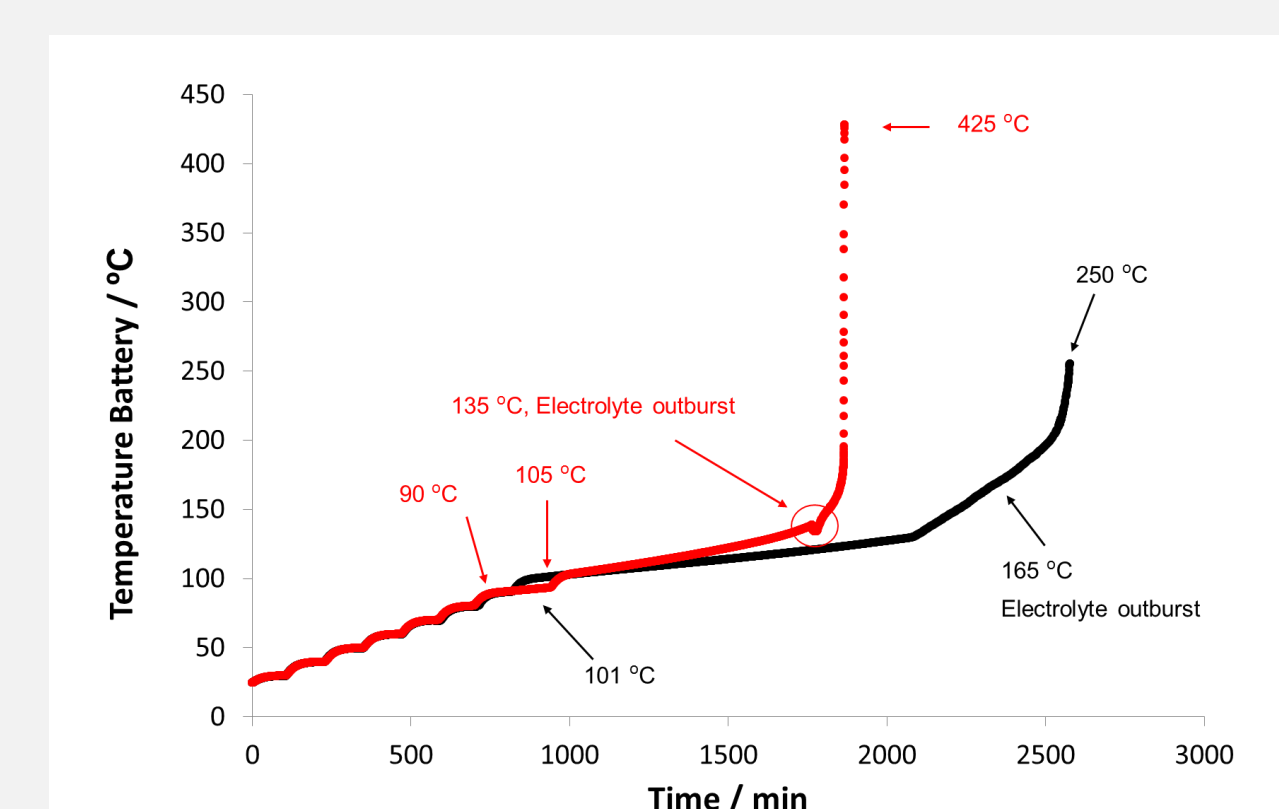
- Analysis of oxidations and reductions
- Run with different electrolytes and gases for Li-air cathodes in half cells at various temperatures

Electrochemical impedance spectroscopy [2]



- Electrolyte resistance influenced by Li_2S_x dissolution
- Formation of insulating layer (R_3) during discharge

Adiabatic reaction calorimetry



- Investigation of the Thermal Runaway
- Battery safety can be quantified

- [1] N. A. Cañas, A. L. P. Baltazar, M. A. P. Morais, T. O. Freitag, N. Wagner, K. A. Friedrich, *Electrochim. Acta* **2015**, 157, 351.
 [2] N. A. Cañas, K. Hirose, B. Pascucci, N. Wagner K. A. Friedrich, R. Hiesgen, *Electrochim. Acta* **2013**, 97, 42.
 [3] N. A. Cañas, D. N. Fronczek, N. Wagner, A. Latz, K. A. Friedrich, *J. Phys. Chem. C* **2014**, 118, 12106.
 [4] N. A. Cañas, S. Wolf, N. Wagner, K. A. Friedrich, *J. Power Sources* **2013**, 226, 313.
 [5] D. Wittmaier, N. Wagner, K. A. Friedrich, H. M. A. Amin, H. Baltruschat, *J. Power Sources* **2014**, 265, 299.
 [6] D. Wittmaier, N. A. Cañas, I. Biswas, K. A. Friedrich, *Adv. Energy Mater.* **2015**, doi: 10.1002/aenm.201500763.

